

New data on the morphology and natural history of *Tetradactylus ellenbergeri* (Angel, 1922) (Sauria: Gerrhosauridae) and *Trachylepis ivensii* (Bocage, 1879) (Sauria: Scincidae) in northeastern Zambia

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Abstract. We report new observations regarding the morphology, behaviour and habitat of the two sparsely known lizards *Tetradactylus ellenbergeri* (Gerrhosauridae) and *Trachylepis ivensii* (Scincidae) from northeastern Zambia and review the available data about the distribution of both species.

Key words. Sauria, *Trachylepis ivensii*, *Tetradactylus ellenbergeri*, habitat, Africa, Ikelenge, Zambia.

In 2008, a field study was conducted in the Ikelenge area (northern Mwinilunga District) of Zambia to explore the unique diversity of amphibians and reptiles in this national biodiversity hotspot. Ikelenge is situated in the extreme north-western edge of Zambia within a pedicle wedged between Angola and the Democratic Republic of the Congo (DR Congo). Three other studies on the herpetofauna were conducted in this area in the past. Donald Broadley (1991) was the first who summarized a checklist of reptiles and amphibians of the northern Mwinilunga district. He recorded 57 reptiles and 35 amphibian species, including *Tetradactylus ellenbergeri* Angel, 1922 for the first time in the area. Later, in 1994, Alan Channing, Robert Drewes and Jens Vindum also did a field survey which was mainly concentrated on amphibians. The results of this study were never published but aspects are mentioned in a book on southern African amphibians (Channing 2001). Also Haagner et al. (2000) collected a series of both amphibians and reptiles from this area, including some records of *T. ellenbergeri*, and the discovery of *Trachylepis ivensii* Bocage, 1879 for the first time for Zambia and the DR Congo.

The herein described field survey was conducted between July and September 2008 to collect amphibians and reptiles. In this area the rainy season is nearly over in March and therefore this study was done, like the Haagner study (W.B. Branch, pers. comm.), in the colder dry season just after the rainy but before the hot dry season. During the study time seven specimens of *Tetradactylus ellenbergeri* and six specimens of *Trachylepis ivensii* were collected (see below). The vouchers are stored and catalogued in the herpetological collections of the Zoologi-

sches Forschungsmuseum Alexander Koenig (ZFMK) in Bonn, Germany and the Muséum d'histoire naturelle (MHNG), Geneva, Switzerland.

Notes on *Tetradactylus ellenbergeri* (Angel, 1922)

Tetradactylus ellenbergeri is a snake-like plated lizard from southern central and eastern Africa and the sole member of the genus in Zambia. The genus is characterized by extremely reduced limbs. In *T. ellenbergeri* the front limbs are lacking and the hind limbs are reduced to about 2 mm. The tail is long, more than three times longer than the body. Individuals are slightly bluish above, with two median vertebral rows of brown scales. The temporal region is spotted brownish; the underside is pale olive (see fig. 1a).

Vouchers. ZFMK 88526–529, ZFMK 89188, ZFMK 89421, ZFMK 92525. Most of the voucher specimens were found within the Nchila Reserve, Hillwood Farm, near Ikelenge. One specimen (ZFMK 88529) was found by local collectors in the surrounding area. Five of the seven preserved specimens are adults and have a snout-vent length (SVL) between 59.7 and 68.5 mm, with an average of 64.0 mm (n= 5). The single subadult (ZFMK 88529) measures 41.4 in SVL. The sole juvenile (ZFMK 92525) measures 30.6 mm and has an original tail with a length (TL) of 93.8 mm. In adults, the TL measured in average 186.2 mm (114.2–250.0 mm; n=5) but in four specimens the tip is cut or the tail is regenerated. The only specimen (ZFMK 88528) with an original tail measured

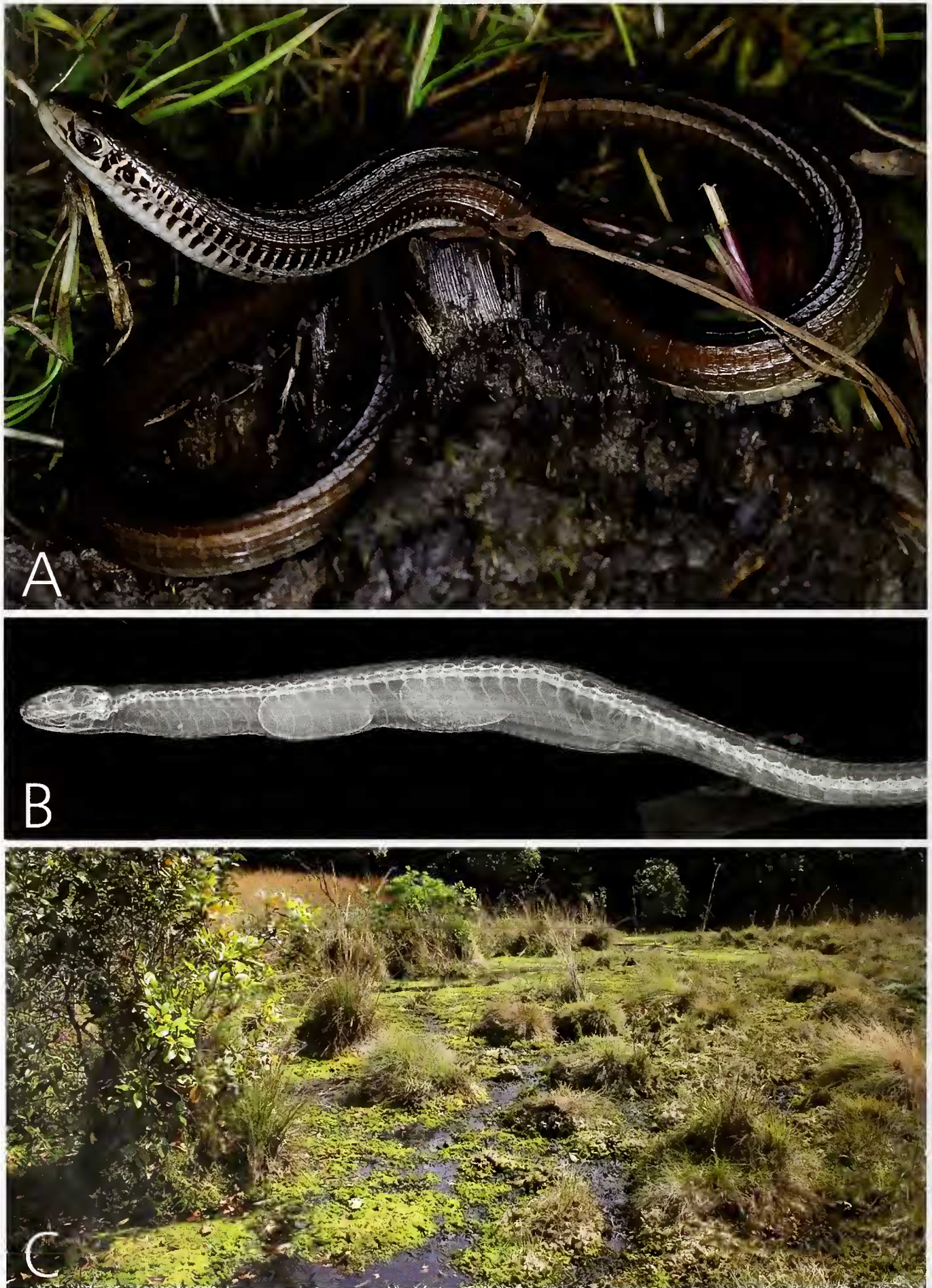


Fig. 1. *Tetradactylus ellenbergeri*. **A=** Specimen from Nchila Reserve, Hillwood Farm, Ikelenge, Zambia. **B=** X-ray image of a pregnant female containing two eggs of *T. ellenbergeri*. **C=** Habitat of *T. ellenbergeri* in the Nchila Reserve.

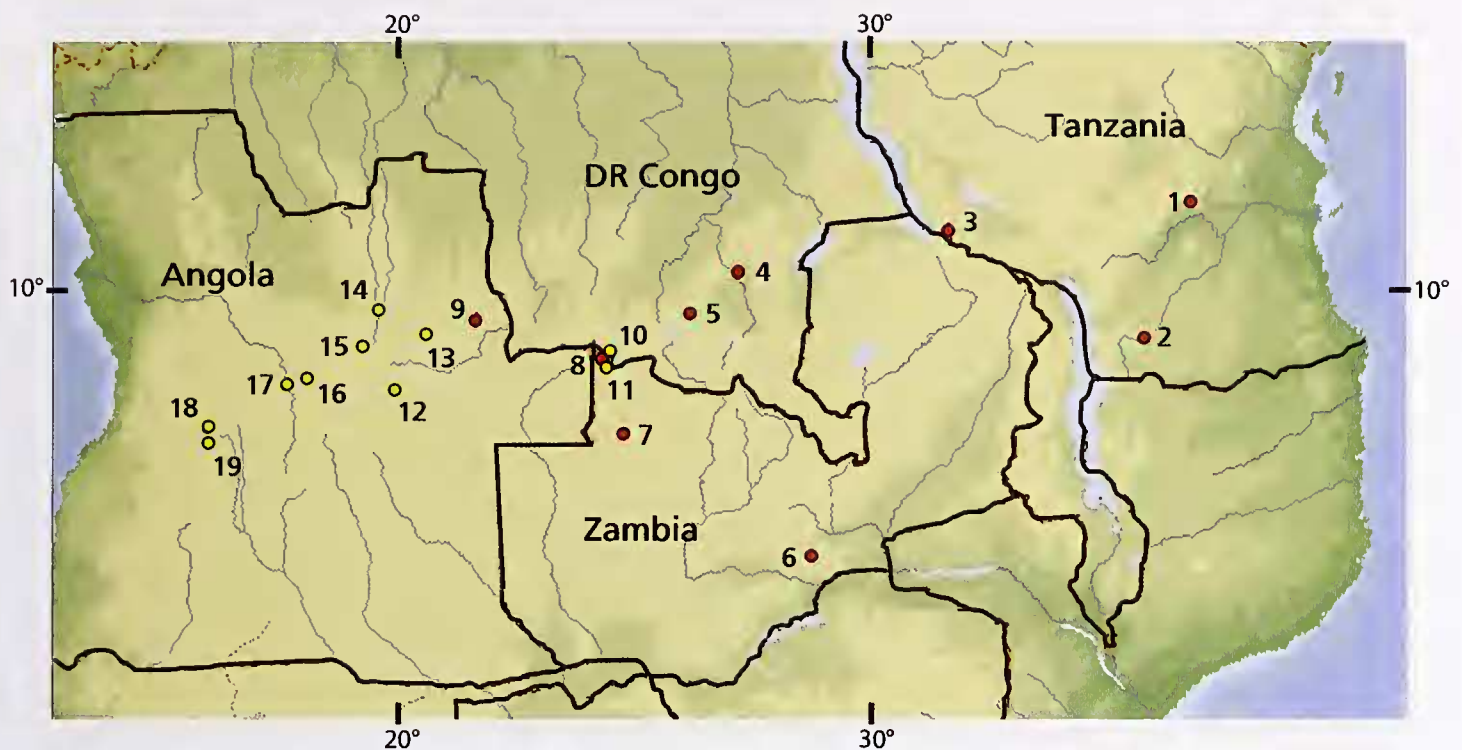


Fig. 2. Distribution of *Tetradactylus ellenbergeri* and *Trachylepis ivensii*. *T. ellenbergeri*. 1= Tanzania: Gendawaki Valley, Udzungwa Mountains (Menegon et al. 2006). 2= Tanzania: Tatanda (Spawls et al. 2002). 3= Tanzania: Songea (Spawls et al. 2002). 4= DR Congo: Kundelungu (Broadley 1971). 5= DR Congo: Kansenia (Broadley 1971). 6= Zambia: Chongwe River (Broadley 1971). 7= Zambia: Lunga Game Reserve (Broadley 1971). 8= Zambia: Ikelenge area. 9= Angola: Lunda (Broadley 1971). *T. ivensii*. 10= DR Congo: Sanolumba Village (Branch & Haagner 1993). 11= Zambia: Ikelenge area, including source of the Zambezi and north of Ikelenge hospital (Branch & Haagner 1993). 12= Angola: Luena (Branch & Haagner 1993). 13= Angola: Dala, Lunda (Branch & Haagner 1993). 14= Angola: Alto Cuilo (Branch & Haagner 1993). 15= Angola: Alto Chicapa (Branch & Haagner 1993). 16= Angola: Luando River (Branch & Haagner 1993). 17= Angola: Curanza River (Branch & Haagner 1993). 18= Angola: Cuando River (Branch & Haagner 1993). 19= Angola: Huambo (Branch & Haagner 1993).

SVL: 60.5 mm and TL: 231.0 mm. This results in a TL/SVL ratio of 3.81, and therefore the tail is about four times longer than the body. Broadley (1991) mentioned a subadult specimen (National Museums of Zimbabwe, NMZB 10663) with a SVL of 56 mm and a TL of 200 mm, a ratio of 3.57.

Distribution. In Tanzania, the species is only known from three localities: Tatanda and Songea are mentioned by Spawls et al. (2002), whereas Menegon et al. (2006) found the species also at Gendawaki Valley in the Udzungwa Mountains which is the easternmost record. In Zambia it is known from three localities (Chongwe River, Lunga Game Reserve, Ikelenge area), and even in DR Congo and Angola it is only known from few localities (see fig. 2).

Habitat. Spawls et al. (2002) noted that the Tanzanian specimens live in moist savanna. All specimens from the Nchila Reserve were found in a similar habitat (fig. 1c), a swampy grassland, interspersed with grass tussocks. A typical such habitat is about six metres broad and 300 metres in length, bordering the gallery forest of the Sakeji

River. Specimens of *T. ellenbergeri* were captured during daytime, basking on the top of grass tussocks. If disturbed, they tried to escape, diving into the water between the tussocks. The muddy water is relatively deep, between 10 and 30 cm. *Sphagnum* moss (Bryophyta, Sphagnaceae) and sundew plants (Magnoliophyta, Droseraceae) were found between the tussocks in this habitat. Both plants indicate a permanent water body. In the more open areas of the water body, *Sphagnum* spec. is dense and overgrows the expanse of water.

Natural history. Spawls et al. (2002) mentioned the species as diurnal and probably oviparous. Haagner et al. (2000) recognized ova and eggs in several specimens collected in April, but one adult female (ZFMK 88526, field no. PW HF 296) collected much later in the year, on August 18th, 2008 also contained two well developed eggs (see fig. 1b).

If grasped, these lizards readily shed their tails. However, tail regeneration is rapid, probably because the tail is essential for locomotion. A captive specimen regenerated one centimetre of a freshly lost tail in four weeks.



Fig. 3. *Trachylepis ivensii*. **A**= Specimen from Nchila Reserve, Hillwood Farm, Ikelenge, Zambia. **B**= Typical habitat of *T. ivensii* in the Nchila Reserve. **C**= Typical habitat of *T. ivensii* at the Zambezi north of Ikelenge.

Notes on *Trachylepis ivensii* (Bocage, 1879)

Trachylepis ivensii is a relatively poorly known scincid lizard from south-western central Africa and has so far only been recorded from a handful of vouchers worldwide. Branch & Haagner (1993) reported 21 specimens collected by them and 17 are preserved at the Port Elizabeth Museum (PEM). Additionally, two specimens were donated to the Lambiris private collection and two to the Natural History Museum of Zimbabwe (NMZB). Nine specimens are present in the collection of the American Museum of Natural History (AMNH) and three at the California Academy of Science (CAS). Also Boulenger (1887) mentioned one specimen present in the collection of the British Museum (BMNH). Together with the six specimens collected in this study, only 40 vouchers exist in museums worldwide. The specimens mentioned by Bocage (1879) including the name bearing type are lost (Branch & Haagner 1993).

T. ivensii is a large, elongate species of the genus with a greatly enlarged tail (see fig. 3a). It is characterized by having two to three (usually three) ear lobules and 28–32 scales rows around midbody. Body scales are keeled and heavily keeled over the middle of the back.

Belly, throat, underside of tail and limbs are patternless; limbs are dark brown, with two fine darker lines on the upper sides of the forelimbs and a white band separating the upper and lower surfaces of the hindlimbs. Head and body are covered with a stripe pattern. On the back and the tail are three (one vertebral, two dorsolateral) pale brown stripes, arising at the temporal region. A white and dark framed stripe arises on both sides at the nasal region and runs beneath the eye and through the ear along the flanks and fades above the top of the hind limbs. A second such stripe arises beneath the ear and runs along the lateral part of the body, separating the belly from the flanks, passing the hind limbs and extending on the tail to the tip. The stripes are lacking on regenerated parts of the tail. Further characteristics of the species are described by Branch & Haagner (1993) and can be seen in figure 3a.

Vouchers. ZFMK 88547–551, MHNG 2713.34.

Distribution. This skink is only known from Angola, Zambia and south-western DR Congo. Branch & Haagner (1993) recorded it for the first time in Zambia, from the northern Mwinilunga District and the adjacent DR Congo, which are the only known localities from these countries to date. In Zambia the species was only found along the Sakeji and Zambezi rivers at Ikelenge area; the DR Congo record is from Salolumba village, 46 km north east of Sakeji. In Angola, *T. ivensii* is known from several rivers in the centre of the country (see fig. 2).

Habitat. This species was always found near water bodies or muddy areas, within open grass- or woodland. Specimens were observed along the Sakeji and Zambezi River, only a few metres away from the riverbank (see fig. 3c). If there was gallery forest, individuals were never observed on the riverbank, but along the forest border in muddy grassland (see fig. 3b). However, the species is not just known from watercourses. Voucher specimens in the collection of the California Academy of Sciences (CAS 196639–641) came from fishponds on Hillwood Farm, near Ikelenge. Branch & Haagner (1993) found their vouchers basking on logs alongside the origin of the Zambezi River and near Ikelenge hospital at the Zambezi rapids. Additionally, they found individuals along the Sakeji River at Sakeji School, near Ikelenge.

Natural history. Previous authors recognized the partially aquatic habits of this species. Laurent (1964) noted that local people found the lizard in fish traps, whereas Manças (1963) found the lizards in muddy areas alongside riverbanks. Haagner et al. (2000) gave a detailed description of the behaviour and mentioned specimens basking on vegetation on the banks of the Sakeji River. If disturbed the lizards leapt into the water, swam underwater with lateral undulations of body and tail and escaped into submerged vegetation. We also observed this behaviour. One specimen we tried to catch close to the riverbank jumped off a small cliff into 1.5 m deep water and escaped. Surprisingly, three individuals were found in holes that presumably were self-excavated by the skinks; one of these was dug out by a local man. These burrows were about 20 to 30 cm in length and in a distance from river bank of about one to two meters. However, despite the fact that *T. ivensii* only lives near water sources and also swims, dives and jumps into the water to escape capture, it is not an aquatic species, and probably similar to the African semi-aquatic species *Varanus niloticus* (Varanidae) and the members of the scincid genus *Cophoscincopus* from West Africa (Böhme et al. 2000).

Very recently, Blackburn & Flemming (2012) have shown that reproducing females ovulate tiny eggs and later supply the nutrients for development by placental means. Moreover, the recognized pattern of fetal membrane development in *T. ivensii* is unique among vertebrates and the species represents a new extreme in placental specializations of reptiles (Blackburn & Flemming 2012).

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REFERENCES

- Angel F (1922) Sur un Léopard d'un genre nouveau de la famille de Gerrhosauridae. Bulletin du Muséum National d'Histoire Naturelle (Paris) 28: 150–152
- Blackburn DG, Flemming AF (2012) Invasive implantation and intimate placental associations in a placental African lizard, *Trachylepis ivensi* (Scincidae). Journal of Morphology 273: 137–159
- Bocage JVB du (1879) Reptiles et batraciens nouveaux d'Angola. Journal of the Academy of Sciences of Lisbon 7: 97–99
- Boulenger GA (1887) Catalogue of the lizards in the British Museum (Natural History). Vol. III. Lacertidae. London, 1887: I–XII + 1–118
- Branch WR, Haagner GV (1993) The skink *Mabuya ivensii*: new records from Zambia and Zaire, and the status of the subspecies *septemlineata* Laurent 1964 and the genus *Lubuya* Horton 1972. Amphibia-Reptilia 14: 105–115
- Bauer AM, Jackman T (2008) Global diversity of lizards in freshwater (Reptilia: Lacertilia). In: Balian EV, Lévêque C, Segers H, Martens K, eds. Freshwater Animal Diversity Assessment. Springer, Netherlands, pp. 581–586
- Böhme W, Schmitz A, Ziegler T (2000) A review of the West African skink genus *Cophoscincopus* Mertens (Reptilia: Scincidae: Lygosominae): Resurrection of *C. simulans* (Vaillant, 1884) and description of a new species. Revue suisse de Zoologie 107: 777–791
- Broadley DG (1991) The herpetofauna of northern Mwinilunga District, northwestern Zambia. Arnoldia Zimbabwe 9: 519–538
- Channing A (2001) Amphibians of central and southern Africa. Cornell University Press, 470 pp.
- Haagner GV, Branch WR, Haagner AJF (2000) Notes on a collection of reptiles from Zambia and adjacent areas of the Democratic Republic of the Congo. Annals of the Eastern Cape Museums 1: 1–25
- Laurent RF (1964) Reptiles et batraciens de l'Angola (troisième note). Companhia de Diamantes de Angola (Diamang), Serviços Culturais, Museu do Dundo (Angola), No. 67, 165 pp.
- Manças S (1963) Saurios de Angola. Junta Invest. Ultramar. 2nd ser. 43: 223–240
- Menegon M, Salvidio S, Moyer D (2006) Reptiles and amphibians from a montane grassland: Gendawaki Valley, Udzungwa Mountains, Tanzania. African Herp News 40: 8–14
- Schmitz A, Brandley MC, Mausfeld P, Vences M, Glaw F, Nussbaum RA, Reeder TW (2005) Opening the black box: phylogenetics and morphological evolution of the Malagasy fossorial lizards of the subfamily 'Scincinae'. Molecular Phylogenetics and Evolution 34: 118–133
- Spawls S, Howell K, Drewes RC, Ashe J (2002) A field guide to the reptiles of East Africa. Academic Press, 543 pp.